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Indian Standard

2-JAW AND 3-JAW POWER OPERATED HIGH SPEED LATHE CHUCKS WITH THROUGH BORE — SPECIFICATION

ICS 25.080.10

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1999 **Price Group 5**

Machine Tool Elements and Holding Devices Sectional Committee, PE 02

FOREWORD

This Indian Standard was adopted by the Bureau of India Standards, after the draft finalized by the Machine Tool Elements and Holding Devices Sectional Committee had been approved by the Production Engineering Division Council.

The continuous research in the area of enhancing productivity has given rise to better machine tools and the efforts corresponding cutting material with increased cutting speed with coated carbide or ceramic tools. This has created a demand for suitable work holding devices, namely, high speed chucks compatible with machines designated for high spindle speed and the matching tools.

In designing the high speed chucks, the basic consideration is the loss in the gripping force due to centrifugal forces which is proportional to square of the speed (rpm). This is achieved by reducing jaw weight and minimizing the distance between centre of the gravity of the jaw to the axis of rotation. A reasonable size of bore is provided at the centre of the chuck which is convenient for bar feeding.

Compensating the centrifugal losses by attaching a sliding weight with the base jaw suitable lever, further improves the capabilities of the chuck, in high power grip even at high speeds of revolution.

For the safety of machine bearings the chuck should be dynamically balanced.

Further the chuck inertia should be kept to the minimum to cope up with sudden change in the machine spindle speed.

This standard is one of a series of Indian Standards available on chucks. The other standards in this series are:

IS No.	*Title*
2876 : 1999	3-jaw and 4-jaw scroll manually operated self-centring lathe chucks — Specification (*second revision*)
10612 : 1983	4-jaw independent lathe chucks — Specification (*second revision*)
14725 : 1999	2-jaw and 3-jaw hand operated heavy duty cam type self centring chucks — Specification
14693 : 1999	2-jaw and 3-jaw power operated wedge type chucks — Specification
Doc : PE 02 (0185)	Hand operated heavy duty 4-jaw independent chucks — Specification

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

2-JAW AND 3-JAW POWER OPERATED HIGH SPEED LATHE CHUCKS WITH THROUGH BORE — SPECIFICATION

1 SCOPE

This standard specifies requirements for power operated self centring high speed lathe chucks with through bore.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS/ISO No.	*Title*
1570 : 1996	Schedules for wrought steels for general engineering purposes
2063 : 1988/ ISO 230-1 : 1986	Acceptance code for machine tools Geometric accuracy of machines operating under no-load or finishing conditions (*first revision*)

IS No.	*Title*
2102 (Part 1) : 1993	General tolerances : Part 1 Tolerances for linear and angular dimensions without individual tolerance indications (*third revision*)
2876 : 1999	3-jaw and 4-jaw scroll manually operated self centring lathe chucks — Specification (*second revision*)

3 TYPES

The power operated self centring high speed lathe chucks shall be of two types, namely:

Type A — High speed chuck without centrifugal compensation.

Type B — High speed chuck with centrifugal compensation.

4 TERMINOLOGY

4.1 For the purpose of this standard, the following terms shall apply (*see also* Fig. 1).

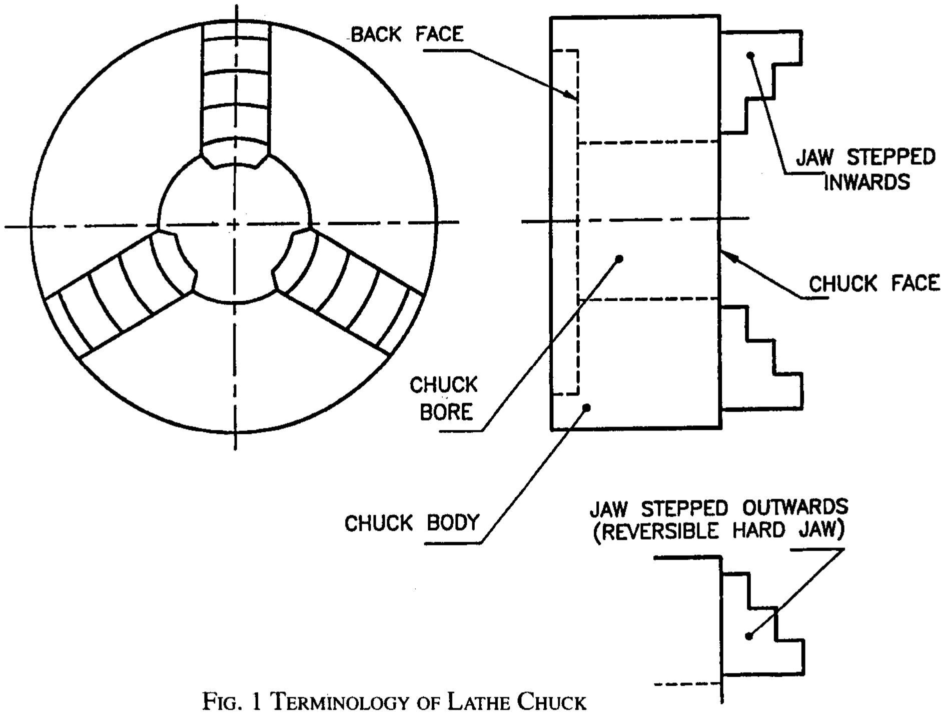


FIG. 1 TERMINOLOGY OF LATHE CHUCK

4.2 Chuck

Device to be mounted on the spindle nose of a machine tool for holding a work piece or a tool (directly or with an adoptor).

4.3 Power Operated Self Centring Chucks

A chuck in which all the jaws move simultaneously towards or away from the axis of the rotation.

4.3.1 This chuck is operated by a hydraulic actuator linked to the chuck operating mechanism to move the jaws simultaneously inward or outward, radially to grip the work piece, concentric to the axis of rotation.

NOTE — The actuators also should match the speed of the chuck.

4.4 Hollow High Speed Chuck

Chuck having a larger through bore and able to function at high speeds with adequate gripping force.

4.5 Chuck Body

That part of the chuck which encloses operating mechanisms, jaws and provides for mounting.

4.5.1 *Chuck Face*

The face from which the master jaws protrude.

4.5.2 *Back Face*

The face of chuck that contacts the face of the spindle or adaptor when the chuck is mounted on the machine.

4.5.3 *Bore of the Chuck*

A through central hole in the chuck body.

4.6 Master Jaw (Base Jaw)

The part formed to fit in the jaw slot of the chuck body and provides for mounting top jaw either hard or soft. Master jaws. once fitted in a body shall not be interchanged.

4.7 Top Jaw

The work holding member, intended to be mounted and clamped on the master jaw.

4.7.1 The top jaw can be either hard or soft.

4.7.1.1 Hard jaws have to be ground in position. Once so ground, the jaws shall not be interchanged. The jaws are reversible.

4.7.1.2 Soft jaws have to be machined in position. Once removed, jaws have to be remachined after refitment.

4.8 Jaw Actuator (Wedge)

The member of the chuck connected to power source which moves the base jaw through chuck operating mechanism.

5 MATERIAL

5.1 Body

Suitable medium carbon steel having a hardness of 190 to 220 HB. Jaw guide ways shall be hardened to 46 to 52 HRC.

5.2 Master Jaw (Base Jaw)

Suitable case hardened steel having hardness between 54 to 60 HRC.

5.3 Jaw Actuator (Wedge)

Suitable steel case hardened to hardness between 54 to 60 HRC.

6 DIMENSIONS

6.1 The dimensions of lathe chucks shall be as given in Table 1.

6.2 Chuck Capacities

The chuck capacities shall be as given in Table 2.

7 Designation

7.1 Power operated high speed chuck, shall be designated by type, nominal dia and number of this standard.

Example:

A power operated high speed chuck of nominal dia 200 of Type A shall be designated as:

High Speed Chuck IS 14694-A-200

NOTES

1 Dimensional deviations for untoleranced dimensions shall be of medium class according to IS 2102 (Part 1).

2 For high speed chuck Type A — The loss of gripping force at rated rpm should not exceed 50 percent.

3 For high speed chuck with centrifugal compensation Type B — The loss of gripping force at rated rpm should not exceed 35 percent.

8 MOUNTING INSTRUCTIONS

The lathe chucks shall be mounted on the lathe spindle as shown in Fig. 2.

9 TESTING

9.1 Geometrical Test

9.1.1 *Preliminary Remarks*

Since all the geometrical tests to be carried out involve the chuck rotation, the chuck should be mounted on the suitable test spindle. The mounting of the chuck on the spindle nose shall be made either directly on the spindle nose or with an adaptor placed between the spindle nose and the chuck. The flange or the adaptor shall have been already previously tested for the accuracy of the dimensions, concentricity with the spindle axis and absence of face out of the flange or adaptor.

9.1.2 *Spindle Accuracy*

The spindle accuracy shall be tested according to IS 2063 and **8.2.11** of IS 2876.

9.2 Concentricity of Outside Diameter

When a chuck is mounted on spindle as shown in Fig. 1, the concentricity of the outside diameter shown by a dial indicator reading shall be within the limit of tolerance as given in Table 3.

9.3 Accuracy of Grip on Test Bar

The accuracy required shall be as given in Table 4.

9.3.1 This test shall be carried out with mandrels of three different diameters as given in Table 4 for each size of chuck. The mandrel shall be clamped by jaws stepped outwards and the dial gauge shall be engaged on the mandrel at a distance '*l*' from the jaw. The dial gauge reading shall not exceed the maximum values given in Table 4.

9.3.2 The accuracy of test bar to be used shall conform to the requirements given in **A-1** of IS 2063.

9.4 Accuracy of Grip on Test Ring

9.4.1 *External Jaws*

The accuracy of grip of external jaws shall be as given in Table 5.

9.4.2 *Internal Jaws*

The accuracy of grip of internal jaws shall be as given in Table 6.

9.5 Dynamic Balancing

The balance of the chuck shall be tested in the following manner:

> The chuck shall be mounted on a mandrel which shall incorporate an adaptor integral with it and accurately finished to fit the bore of the chuck to be tested.

The mandrel with adaptor should have been already balanced with the chuck being mounted on it. The location of the cap screws, bolts or studs for holding the chuck on the adaptor shall be in balance. The chuck shall then be mounted on the adaptor and the mandrel placed on knife edges as shown in Fig. 3. Then chuck is required to run at the limits specified in Table 7 and the arrangement for dynamic balancing shall be as given in Fig. 3.

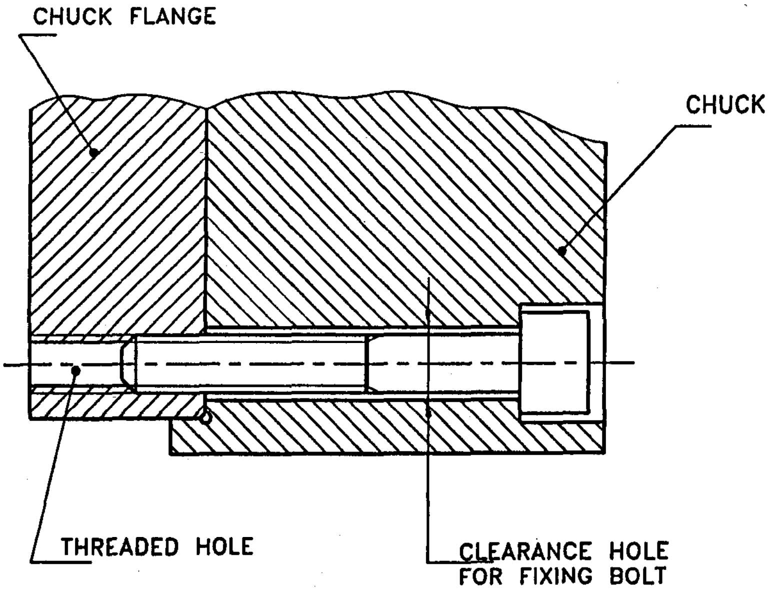


Fig. 2 Mounting of Chuck

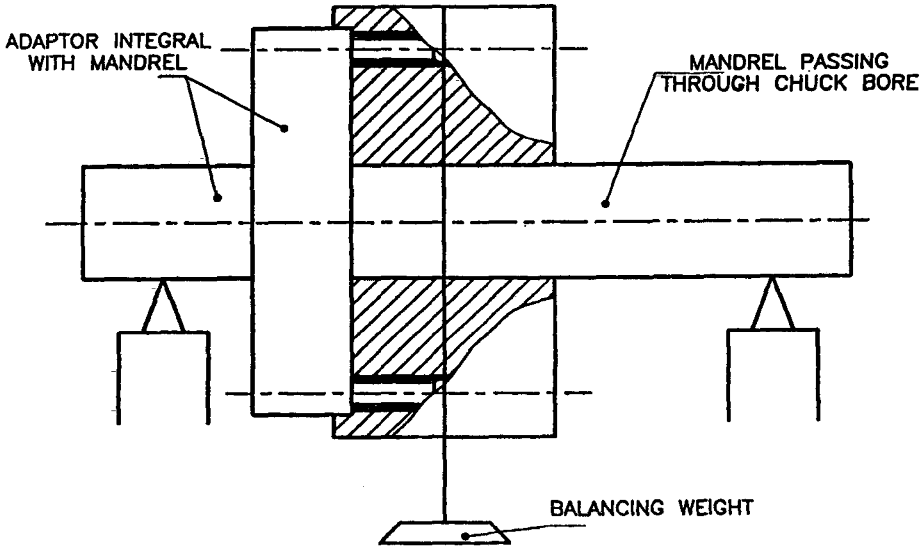

ADAPTOR INTEGRAL WITH MANDREL
MANDREL PASSING THROUGH CHUCK BORE
BALANCING WEIGHT

FIG. 3 TEST ARRANGEMENT FOR STATIC BALANCE

The test shall be carried cut only when the chuck is completely dry inside and without top jaws, T-nuts/hexagon socket cap screws.

10 RIGIDITY

10.1 The rigidity of a chuck shall be expressed in terms of its ability to reproduce its accuracy of grip on a test bar after having been subjected to the gripping and cutting tests.

10.1.1 The test shall be carried out as detailed below:

a) The chucks shall be mounted on a lathe of adequate power and rigidity and a test bar shall be gripped in the jaws. The cutting test shall then be carried out at the feeds and depth of cut as specified below:

Nominal Size Chuck, mm	*Feed*, mm/rev	*Depth of Cut*, mm	*Cutting Speed*, m/min
165	0.30	4.0	100
200	0.30	4.0	100
250	0.40	6.0	100
315	0.40	6.0	100
400	0.50	8.0	100
500	0.50	8.0	100
630	0.50	8.0	100

b) The test bar shall be made of steel conforming to Grade C14 of IS 1570 and suitably heat treated to hardness of 20 HRC.

c) The diameter of the test bar shall be equal to the maximum capacity of the chuck for bar work as specified by the manufacturer.

d) The length of the test bar hanging out beyond the chuck jaw for this shall be twice the diameter of the bar.

e) During the turning test; the bar shall not be supported by any centre or steady rest.

f) After completion of the test as specified in **10.1.1** (a), the chuck shall be capable of retaining its original accuracy of grip as specified in **9.3** and **9.4**.

10.1.2 The rigidity test is not a routine test, and shall be carried out as agreed between the purchaser and the manufacturer.

11 PRESERVATION AND PACKING

11.1 The chuck shall be given suitable anti-corrosive surface treatment.

11.2 The chuck shall be packed in accordance with best trade practice.

12 MARKING

12.1 The chucks shall be marked at an appropriate place with manufacturer's name or trade-mark, size, maximum speed and maximum actuating force.

12.2 BIS Certification Marking

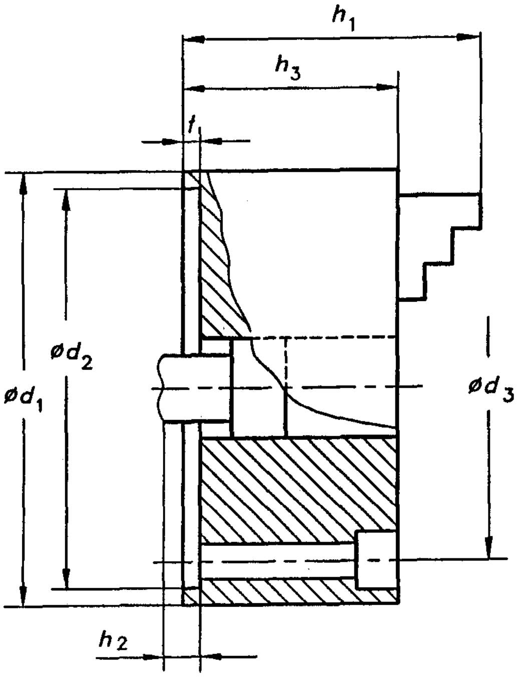
The product conforming to this standard may also be marked with the Standard Mark.

12.2.1 The use of the Standard Mark is governed by the provision of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 1 Dimensions of Lathe Chucks

(*Clause* 6.1)

All dimensions in millimetres.

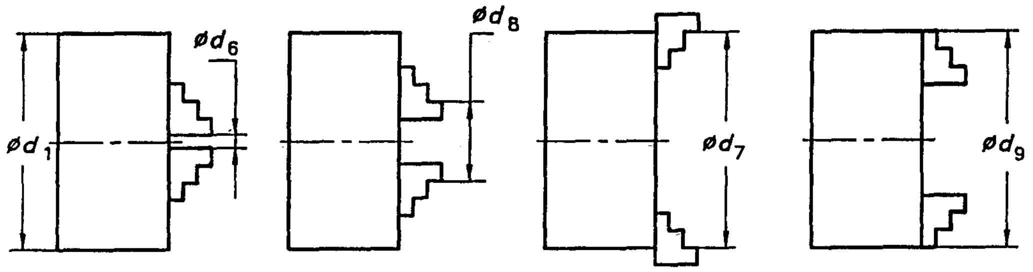


Sl No.	Nominal Size, ϕd_1	ϕd_2	PCD		Actuator Stroke h_2	ϕd_5	t	h_1		Maximum Speed, rpm		Maximum Draw Bar Pull, kN (kgf)
(1)	(2)	H 6 (3)	ϕd_3 (4)	Tol (5)	(6)	(7)	(8)	Type A (9)	Type B (10)	Type A (11)	Type B (12)	(13)
i)	165	150	125	±0.25	15	36	5	135	–	5 500	6 000	29.43 (3 000)
ii)	200	170	133.4	±0.3	20	48	6	149	152	5 000	6 000	39.24 (4 000)
iii)	250	220	171.4	±0.35	20	65	6	160	170	4 000	4 500	58.86 (6 000)
iv)	315	300	235	±0.4	20	82	6	164.5	184.5	3 200	4 000	58.86 (6 000)
v)	400	380	330.2	±0.4	30	120	6	218.5	218.5	2 500	3 000	88.29 (9 000)
vi)	500	380	330.2	±0.4	30	160	6	218.5	218.5	2 000	2 500	88.29 (9 000)
vii)	630	380	330.2	±0.4	43	168	6	218.5	–	1 500	–	88.29 (9 000)

Table 2 Chuck Capacities

(*Clause* 6.2)

All dimensions in millimetres.



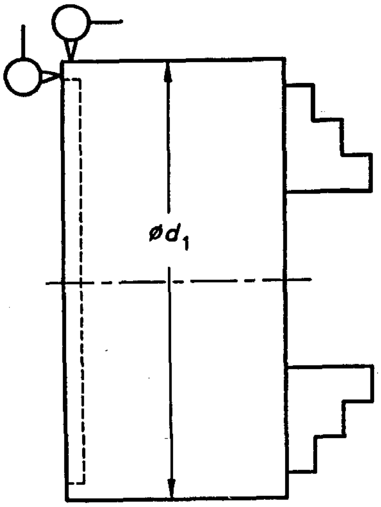
MINIMUM EXTERNAL CLAMPING MINIMUM INTERNAL CLAMPING MAXIMUM EXTERNAL CLAMPING MAXIMUM INTERNAL CLAMPING

Sl No.	Nominal Dia of Chuck, d_1	External Clamping		Internal Clamping	
		d_6 *Min*	d_7 *Max*	d_8 *Min*	d_9 *Max*
(1)	(2)	(3)	(4)	(5)	(6)
i)	165	18	165	105	135
ii)	200	35	200	66	200
iii)	250	42	250	74	250
iv)	315	56	315	74	315
v)	400	68	400	116	400
vi)	500	77	500	134	500
vii)	630	89	630	150	630

Table 3 Concentricity of Outside Diameter

(*Clause* 9.2)

All dimensions in millimetres.

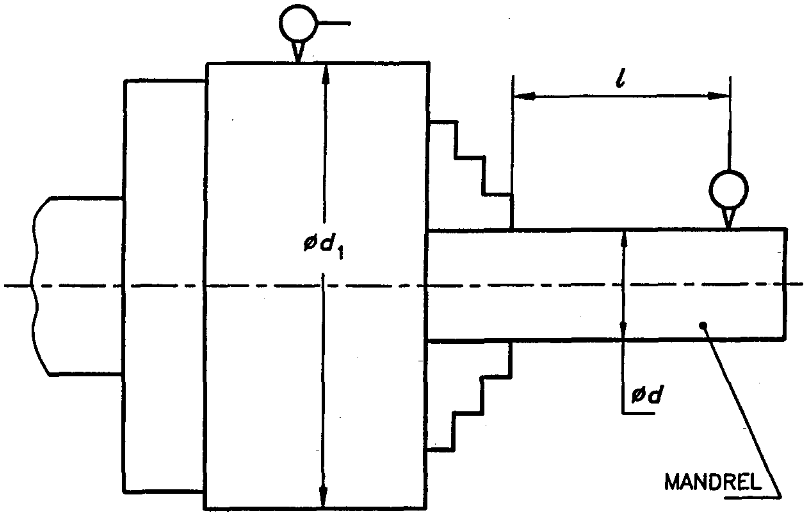


Sl No.	Nominal Dia of Chuck, ϕd_1		Permissible Deviation (TIR) in mm	
	From	Up to and Including	Radial	Axial
(1)	(2)	(3)	(4)	(5)
i)		165	0.02	0.02
ii)	200	250	0.04	0.02
iii)	315	400	0.05	0.03
iv)	500	630	0.06	0.04

Table 4 Accuracy of Grip on Test Bar

(*Clauses* 9.3 *and* 9.3.1)

All dimensions in millimetres.

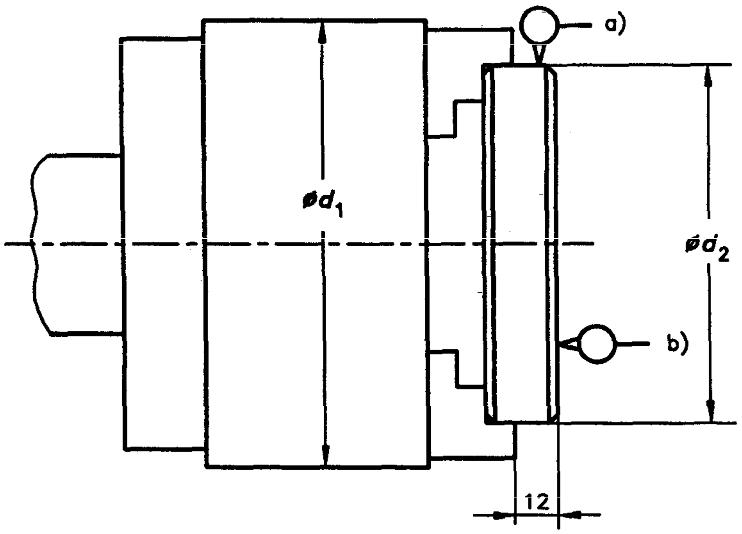


Sl No.	Nominal Dia of Chuck ϕd_1	Diameter of Mandrel ϕd			l	Permissible Deviation (TIR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	165	20	32	50	60	0.05
ii)	200, 250	32	50	80	80	0.06
iii)	315, 400	50	80	125	120	0.08
iv)	500, 630	80	125	200	150	0.1

Table 5 Accuracy of Grip of External Jaws

(*Clause* 9.4.1)

All dimensions in millimetres.



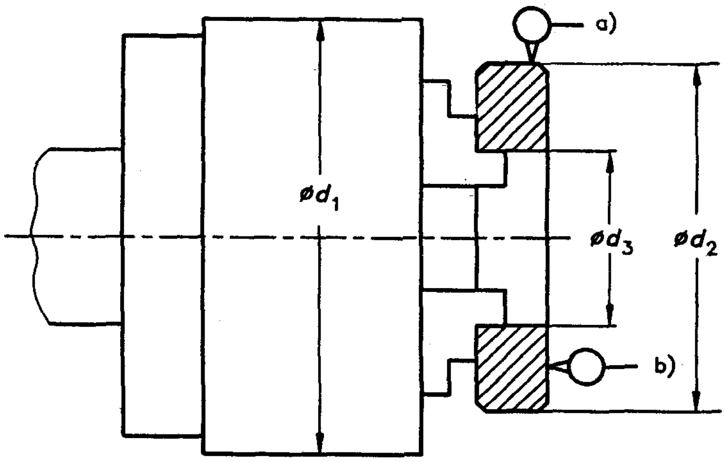
Test	Nominal size of Chuck, ϕd_1		ϕd_2	Permissible Deviation (TIR)
	From	Up to and Including		
(1)	(2)	(3)	(4)	(5)
Reading on periphery *a*)	–	165	100	0.04
	200	250	160	0.06
	315	400	250	0.08
	500	630	400	0.1
Reading on face (as near to periphery as practicable) *b*)	–	165	100	0.03
	200	250	160	0.03
	315	400	250	0.04
	500	630	400	0.04

NOTE — Each jaw step shall be tested. A single test ring should be used for each step. The external diameter of the test ring shall be smaller than the diameter at which the jaws have been ground.

Table 6 Accuracy of Grip on Internal Jaws

(*Clause* 9.4.2)

All dimensions in millimetres.



Test	Nominal Size of Chuck, ϕd_1		ϕd_2	ϕd_3	Permissible Deviation (TIR)
	From	Up to and Including			
(1)	(2)	(3)	(4)	(5)	(6)
Reading on periphery a)	–	165	100	50	0.04
	200	250	160	80	0.06
	315	400	250	125	0.08
	500	630	400	200	0.1
Reading on face *b*) (as near to periphery as practicable)	–	165	100	50	0.03
	200	250	160	80	0.03
	315	400	250	125	0.04
	500	630	400	200	0.04

NOTE — Each jaw step shall be tested. A single test ring should be used for each step. The internal diameter of the test ring shall be larger than the diameter at which the steps of the jaws have been ground.

Table 7 Permissible Imbalance

(*Clause* 9.5)

Chuck Size mm	Permissible Imbalance			
	Type A (g.mm)	Type B (g.mm)	Type A (g)	Type B (g)
165	156	–	1.9	–
200	224	180	2.2	1.8
250	416	420	3.3	3.4
315	684	656	4.3	4.2
400	2 340	1 900	11.7	7.5
500	5 376	4 550	21.5	18.2
630	1 2 600	–	40	–

NOTE — Permissible imbalance in g.mm is calculated as:
Permissible weight (g) × Radius of the chuck (in mm).

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